Check List the journal of biodiversity data

NOTES ON GEOGRAPHIC DISTRIBUTION

Check List 19 (1): 35–40
https://doi.org/10.15560/19.1.35

PENSOFT

First record of the threatened Giant Anteater, *Myrmecophaga tridactyla* Linnaeus, 1758 (Xenarthra, Myrmecophagidae), at the Reserva Particular do Patrimônio Natural Poço Fundo in Minas Gerais state, Brazil

Paola Cardias Soares[1*], Lara Modesto Mendes[1], Rodolfo da Cunha Sarcinelli[1], Kleiber José Vaz de Melo Barbosa[1], Fabiano Rodrigues de Melo[1]

1 Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil • PCS: paola.soares@ufv.br https://orcid.org/0000-0003-3009-8777 • LMM: lmodestomendes@gmail.com https://orcid.org/0000-0003-3971-8047 • RCS: rodolfo.sarcinelli@ufv.br https://orcid.org/0000-0003-2788-7572 • KJVMB: kleiberufv@hotmail.com • FRM: frmelo@ufv.br https://orcid.org/0000-0001-9958-2036

* Corresponding author

Abstract. *Myrmecophaga tridactyla* Linnaeus, 1758, Giant Anteater, is a very sensitive species in the Quadrilátero Ferrífero, a region of the Brazilian state of Minas Gerais responsible for a large part of the country's iron ore production. Information on the occurrence of this species in the area is limited to literature reviews, data papers, and interviews. Here, we present the first record of *M. tridactyla* from the Reserva Particular do Patrimônio Natural Poço Fundo (a natural heritage private reserve) and what is likely to be only the fifth record from the Quadrilátero Ferrífero region. We highlight the importance of larger, connected areas for the long-term survival of this threatened species.

Keywords. Atlantic Forest, fragmentation, Neotropical xenarthrans, Quadrilátero Ferrífero

Academic editor. Guilherme Garbino
Received 12 September 2022, accepted 29 November 2022, published 18 January 2023

Soares PC, Mendes LM, Sarcinelli RC, Barbosa KJCM, Melo FR (2023) First record of the threatened Giant Anteater, *Myrmecophaga tridactyla* Linnaeus, 1758 (Xenarthra, Myrmecophagidae), at the Reserva Particular do Patrimônio Natural Poço Fundo in Minas Gerais state, Brazil. Check List 19 (1): 35–40. https://doi.org/10.15560/19.1.35

Introduction

The original distribution of *Myrmecophaga tridactyla* Linnaeus, 1758, Giant Anteater (Xenarthra, Myrmecophagidae), encompasses a wide area from Belize in Central America to southern South America, except the Andes (Montgomery 1985). Nowadays, however, this species, the largest anteater, is rare or even extirpated in many areas of the Neotropics (Miranda et al. 2014). Population declines has mostly been due to habitat loss, wildfires, poaching, conflicts with dogs, and roadkills (Miranda et al. 2015). Listed as Vulnerable by the International Union for Conservation of Nature (IUCN), the Red List of Threatened Species (Miranda et al. 2018), and by the Brazilian Ministry of Environment (MMA 2022), populations of *M. tridactyla* are most likely to be found in legally protected areas, including areas of permanent protection (APP) and legal reserves (LR) (Versiani et al. 2021).

One of the areas within the geographic range of *M. tridactyla* is the Quadrilátero Ferrífero, an extremely threatened and fragmented region in the state of Minas Gerais, Brazil (Drummond et al. 2005; Carvalho Filho et al. 2010). This area consists of an ecotone between the Atlantic Forest and the Cerrado (Veloso et al. 1991), and the main activity there is the extraction of iron ore (Jacobi 2008). Morcatty et al. (2013) reviewed the occurrence of the giant anteater in the region and found historical literature records and some reports from interviews. Later, Santos et al. (2019) presented a data paper in which these authors found that *M. tridactyla* was the most-recorded xenarthran in Brazil. However, for

©The authors. This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

the Quadrilátero Ferrífero area, only four records were found: one in Itacolomi State Park (with no specified recording method) and three from camera traps installed in the Reserva Particular do Patrimônio Natural (Natural Heritage Private Reserve in English; RPPN) Santuário do Caraça during 2013 and 2014 (P.M. Santos, Instituto Nacional da Mata Atlântica, Brazil, in litt.).

Here, we present the first camera-trap record of *M. tridactyla* from the RPPN Poço Fundo, which is within the Quadrilátero Ferrífero region in Minas Gerais, Brazil. In addition, we also assess species richness for medium-sized and large mammals of the RPPN Poço Fundo.

Methods

This survey is part of a wider project aimed at monitoring mammals in four RPPNs in the Quadrilátero Ferrífero region, which has an area of ~7000 km² in the central part of the state of Minas Gerais, in southeastern Brazil (MME 2011). RPPN Poço Fundo is the smallest area surveyed at 426.73 ha (VALE 2015), and the other three are the Capivary I reserve at 1,984 ha (VALE 2009), the Córrego Seco reserve at 1,797 ha (VALE 2010), and the Cata Branca reserve, with 1,102.89 ha (Oliveira 2018). In the RPPN Poço Fundo, the vegetation types are seasonal semideciduous forest, "campos limpos", "campos", and "cerrado rupestre" on ferruginous soil (VALE 2015).

From 9–11 September 2020, we installed six camera traps (Trophy Cam Bushnell - HD) in the RPPN Poço Fundo (Fig. 1). Three of these cameras were installed in areas of forest, mainly seasonal semideciduous forest, and the other three were installed in open grasslands. The cameras were set to function 24 h a day, at intervals of 10 sec, and in hybrid mode between photos and videos (20 sec for each video). We considered camera-trap recordings as independent observations, if the interval between records were 60 min or more. For intervals <60 min, we considered recordings to represent a single observation.

For the analysis of sampling efficiency, we evaluated the quantitative method in relation to species richness. To calculate the richness estimate, we chose the Jackknife I model (Santos 2003). With the results of the data collection records, we produced a collector efficiency curve, a graphic representation containing the number of sample units on the *x* axis and the cumulative number of recorded species on the *y* axis. All analyzes were performed using the EstimatesS v. 9.0.1 (Colwell 2013).

Results

The total sampling effort for the camera traps installed at the RPPN Poço Fundo was of 1,536 cameras/day, with 35 records and 8 species of medium-sized and large wild mammals sampled. Of these 35 records, 29 were made in the forests and seven in open grasslands. More information on the sampling effort for the cameras installed can be seen in Table 1, and a list of the mammals sampled is shown in Table 2.

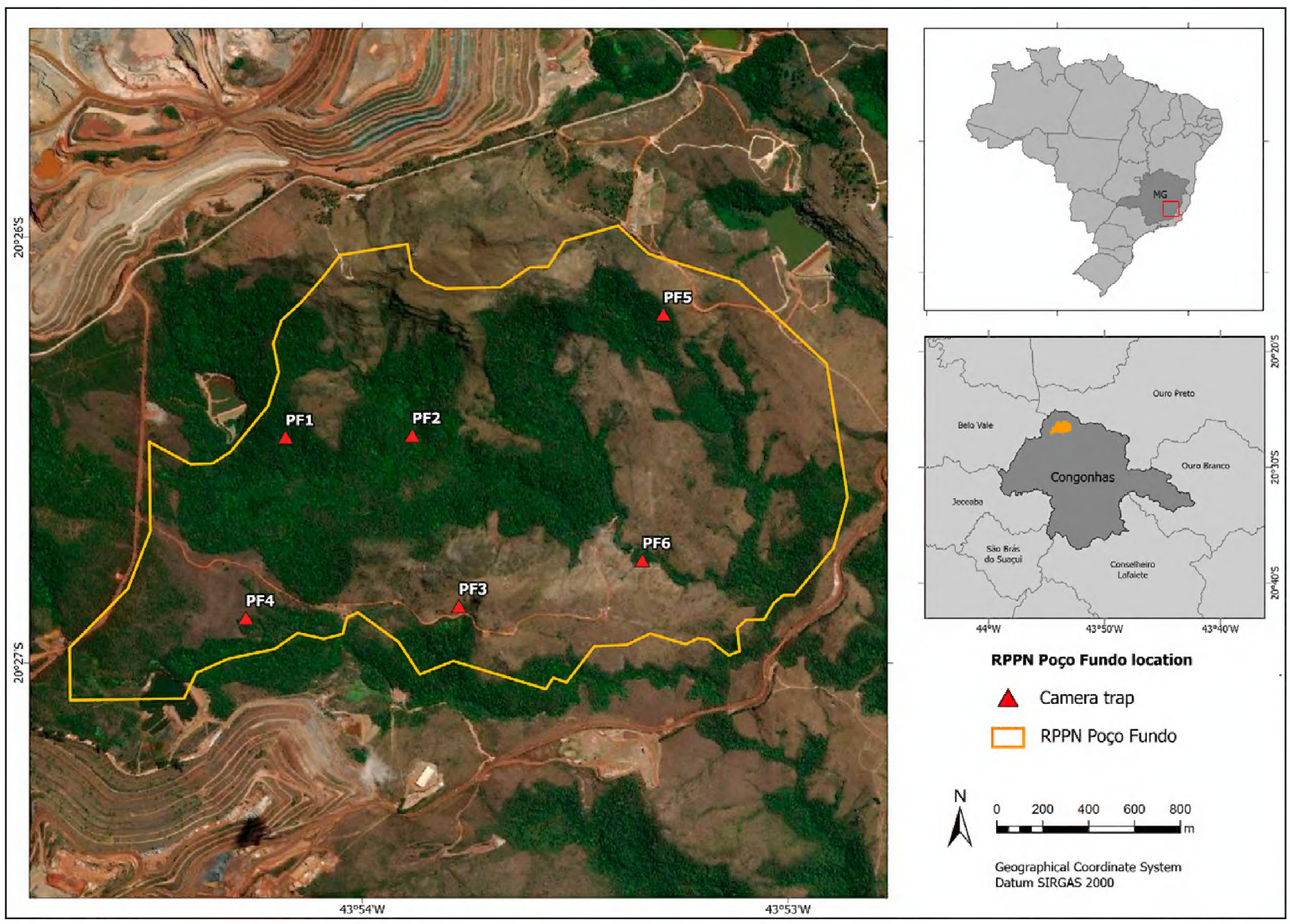

Figure 1. Location of the Poço Fundo Natural Heritage Private Reserve (RPPN Poço Fundo).

Table 1. Cameras installed at the Reserva Particular do Patrimônio Natural Poço Fundo. The day each camera was installed and uninstalled, the area sampled, and number of days that data were recorded are included.

Cameras	Start date	End date	Area	Days
PF1	09/09/2020	04/28/2021	Forest	258
PF2	09/11/2020	04/28/2021	Forest	254
PF3	09/09/2020	04/28/2021	Open grassland	258
PF4	09/09/2020	04/28/2021	Open grassland	258
PF5	09/11/2020	04/28/2021	Forest	254
PF6	09/11/2020	04/28/2021	Open grassland	254

Figure 2. Camera trap (PF5) register for the giant anteater (*Myrmecophaga tridactyla*) at the forest area of the Poço Fundo Natural Heritage Private Reserve (RPPN Poço Fundo).

Camera PF5 recorded *Myrmecophaga tridactyla* twice, on 2 November 2020 and on 10 April 2021, and only in the forest area (Fig. 2). Of the four monitored RPPNs (see Methods), *M. tridactyla* was found only at the RPPN Poço Fundo. However, we have yet to finish surveying the Capivary I reserve.

For the sampling efficiency, as we find an overlap between the observed and the estimated species richness curves (Fig. 3), we can confirm that the species richness curve for the Poço Fundo RPPN reached 100%. Thus, our sampling effort was efficient for analysis of medium-sized and large mammal richness within the survey area.

Our new data represents the fifth locality of *M. tridactyla* in the Quadrilátero Ferrífero, if we include the unpublished records compiled by Santos et al. (2019) (Fig. 4). Our observations of this species in a seasonal semideciduous forest are also far from the previously known occurrences in the Quadrilátero Ferrífero, which were from an area of "cerrado rupestre" (VALE 2015; P.M. Santos, Instituto Nacional da Mata Atlântica, Brazil, in litt.).

New records. BRAZIL – Minas Gerais • Congonhas, Poço Fundo Natural Heritage Reserve; 20°26′10.69″S, 043°53′17.57″W; 871 m alt.; 11.II.2020; P.C. Soares, L.M. Mendes, R.C. Sarcinelli, K.J.V.M. Barbosa, F.R. Melo obs.; forest area; camera trap • same data, except 04.X.2021.

Identification. The individuals observed in the camera-trap images were identified as *M. tridactyla* by their distinctive size and pelage pattern. These patterns were compared to the descriptions of all relevant species, and we especially used the recognition method of Möcklinghoff et al. (2018). The individuals recorded by the camera trap were large. They had wide black stripes from the upper front legs toward the spine, a long, distinctive snout, and a bushy tail, which is indicative of *M. tridactyla*.

Discussion

As mentioned, *Myrmecophaga tridactyla* is rare in the survey region and assessed as Vulnerable. The largest populations of *M. tridactyla* occur in Emas National Park in southwestern Goiás state, and in Serra da Canastra National Park in southwestern Minas Gerais state (Miranda 2004). Only two areas of the Quadrilátero Ferrífero have records of this species: Itacolomi State Park and the RPPN do Caraça (Santos et al.

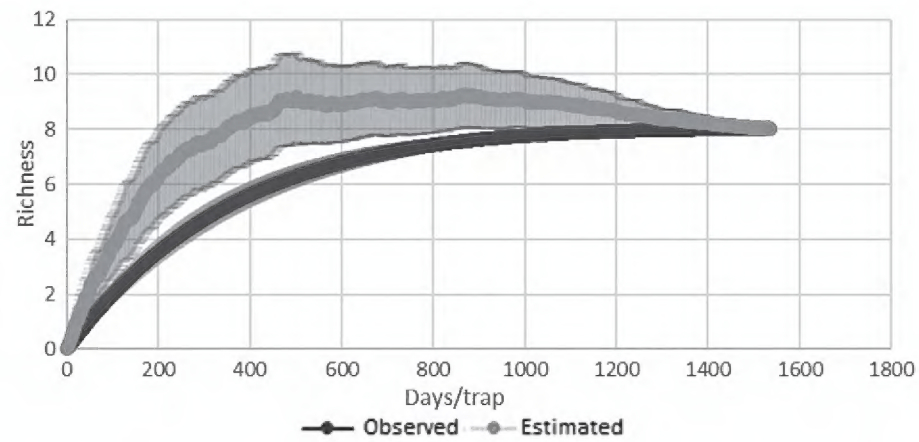

Figure 3. Richness estimation curve for medium and large-sized mammal species in the Poço Fundo Natural Heritage Private Reserve (RPPN). The observed richness is depicted in dark gray, whereas the estimated richness is show by the light gray line.

Table 2. Species recorded on the camera traps installed at the Reserva Particular do Patrimônio Natural Poço. Scientific name, common name, number of records per area, and total number of records are included.

Taxon	Common name	Forest	Open grassland	Total
Eira barbara (Linnaeus, 1758)	Tayra	6	1	7
Galictis cuja (Molina, 1782)	Lesser Grison	3	—	3
Leopardus guttulus (Hensel, 1872)	Southern Tiger Cat	2	—	2
Cuniculus paca (Linnaeus, 1766)	Lowland Paca	5	—	5
Myrmecophaga tridactyla Linnaeus, 1758	Giant Anteater	2	—	2
Tamandua tetradactyla (Linnaeus, 1758)	Southern Tamandua	2	1	3
Cabassous unicinctus (Linnaeus, 1758)	Southern Naked-tailed Armadillo	7	—	7
Sylvilagus minensis Thomas, 1901	Common Tapeti	—	5	5

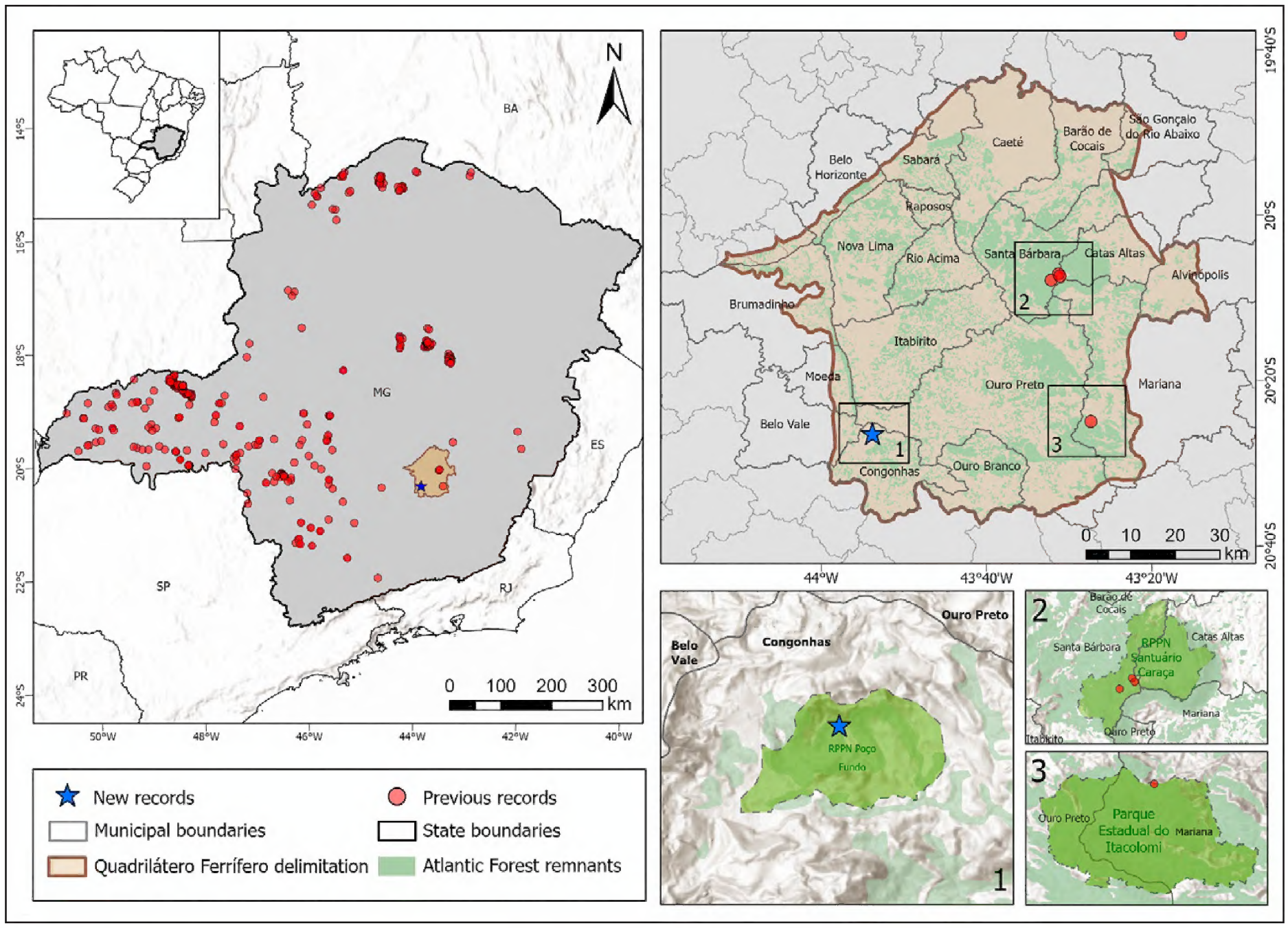

Figure 4. First record of *Myrmecophaga tridactyla* for the Poço Fundo Natural Heritage Private Reserve (RPPN Poço Fundo). Red dots represent the previous records at the State of Minas Gerais compiled by Santos et al. (2019) and the four records for the Quadrilátero Ferrífero area: three in the Santuário Caraça Natural Heritage Private Reserve (RPPN Santuário Caraça), at the Santa Bárbara municipality and one in the Itacolomi State Park, at Mariana municipality.

2019). Morcatty et al. (2013) also reported this species in the Serra da Moeda Mountain Range (also within the Quadrilátero Ferrífero region), but this is based on an interview and, therefore, is not confirmed.

A large portion of Brazil's mining activity is in Minas Gerais, and the Quadrilátero Ferrífero is responsible for a large part of the country's iron ore production (Castro and Ruchkys 2017). However, economic growth provided by mining here has contributed to two of the largest environmental disasters—the rupture of the Mariana and Brumadinho dams (Freitas et al. 2019). The vulnerability of the Quadrilátero Ferrífero to such disasters has been modelled by Dutra et al. (2021), who stated that forest suppression is one of the main consequences of dam ruptures.

The behavioral plasticity of *M. tridactyla* to degraded environments shows some degree of adaptation of this species, as it can transit between forests and open habitats on its daily activities (Vynne et al. 2011; Kreutz et al. 2012; Bertassoni et al. 2020). However, such plasticity has its limitations, and the strong dependence on natural habitats of this species highlights the importance of retaining habitat patches in a human-modified landscape (Vynne et al. 2011; Bertassoni et al. 2020). Thus, heterogeneous landscapes are fundamental for the survival of this species (Bertassoni and Ribeiro 2019; Bertassoni et al. 2019), and forested areas are important as thermal refuges from extreme temperatures, especially for an animal with such low metabolic rate and body temperature (Mourão and Medri 2007; Rodrigues et al. 2008).

Morcatty et al. (2013) reinforced that larger areas of habitat are more hospitable for *M. tridactyla*, for example, the Caraça reserve (10,187 ha) and the Itacolomi State Park (7,543 ha). This species–area size relationship is also reinforced by other studies, for example, by Chiarello (1999), who analyzed Atlantic Forest remnants and reported that medium-sized and large mammals, like *M. tridactyla*, South American Tapir *Tapirus terrestris* (Linnaeus, 1758) and Collared Peccaries *Dicotyles tajacu* (Linnaeus, 1758), appeared only in the largest areas sampled. For example, 200 ha would probably not be large enough to maintain large cats, tapirs, peccaries, giant armadillos, and anteaters.

Fragmentation is a poignant reality for the Atlantic Forest, as evidenced by the absence or rarity of large mammals that were recorded by 19th-century naturalists in Minas Gerais (Wied-Neuwied 1820; Saint-Hilaire 1833). The occurrence of *M. tridactyla* in an Atlantic Forest fragment surrounded by mining activities, like the RPPN Poço Fundo, highlights the importance of conservation actions, such as the regeneration

of forests and the connection of fragmented landscapes, to improve the long-term survival of threatened populations of large mammals.

Acknowledgements

We thank Vale S.A. (Vale S.A, 4600048789) and Funarbe (Fundação Arthur Bernardes, no. 4430), Universidade Federal de Viçosa, and the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (Capes Foundation) for logistic and financial support. We would also like to thank Paloma Marques Santos for providing the original data of previous records for the Giant Anteater in the Quadrilátero Ferrífero area. We are also very thankful for the constructive contributions provided by the reviewers and the academic editor.

Authors' Contributions

Conceptualization: PCS, LMM, RCS, KJVMB, FRM. Data curation: LMM, RCS. Formal analysis: LMM, RCS. Funding acquisition: FRM. Investigation: PCS, LMM, RCS, KJVMB, FRM. Methodology: PCS, LMM, RCS, KJVMB, FRM. Project Administration: LMM, FRM. Resources: FRM. Supervision: FRM. Validation: PCS, LMM, RCS, KJVMB, FRM. Visualization: PCS, FRM. Writing – original draft: PCS. Writing – review & editing: PCS, FRM.

References

Bertassoni A, Costa RT, Gouvea JA, Bianchi RC, Ribeiro JW, Vancine MH, Ribeiro MC (2019) Land-use changes and the expansion of biofuel crops threaten the giant anteater in southeastern Brazil. Journal of Mammalogy 100 (2): 435–444. https://doi.org/10.1093/jmammal/gyz042

Bertassoni A, Mourão G, Bianchi RDC (2020) Space use by giant anteaters (*Myrmecophaga tridactyla*) in a protected area within human-modified landscape. Ecology and Evolution 10 (15): 7981–7994. https://doi.org/10.1002/ece3.5911

Bertassoni A, Ribeiro MC (2019) Space use by the giant anteater (*Myrmecophaga tridactyla*): a review and key directions for future research. European Journal of Wildlife Research 65 (6): 1–11. https://doi.org/10.1007/s10344-019-1334-y

Carvalho Filho A, Curi N, Shinzato E (2010) Relações solo-paisagem no Quadrilátero Ferrífero em Minas Gerais. Pesquisa Agropecuária Brasileira 45 (8): 903–916. https://doi.org/10.1590/S0100-204x2010000800017

Castro PTA, Ruchkys UA (2017) Iniciativas sobre patrimônio geológico e temas correlatos no Quadrilátero Ferrífero, MG. Caderno de Geografia 27 (2): 314–331. https://doi.org/10.5752/p.2318-2962.2017v27nesp2p314

Chiarello AG (1999) Effects of fragmentation of the Atlantic Forest on mammal communities in south-eastern Brazil. Biological Conservation 89 (1): 71–82. https://doi.org/10.1016/S0006-3207(98)00130-X

Colwell RK (2013) Estimates: statistical estimation of species richness and shared species from samples. Museum of Natural History, Boulder, USA. http://purl.oclc.org/estimates. Accessed on: 2022-05-15.

Drummond GM, Martins CS, Machado ABM, Sebaio FA, Antonini Y (2005) Biodiversidade em Minas Gerais—um Atlas para Sua Conservação. 2nd edition. Fundação Biodiversitas, Belo Horizonte, Brazil, 222 pp.

Dutra DJ, Genta AF, Coelho CWGA (2021) Modelagem de superfície de custo aplicado ao mapeamento de áreas vulneráveis ao rompimento de barragens, Quadrilátero Ferrífero – MG. Caderno de Geografia 31 (65): 425-439. https://doi.org/10.5752/p.2318-2962.2021v31n65p425

Freitas CM, Barcellos CB, Asmus CIRF, da Silva MA, Xavier DR (2019) Da Samarco em Mariana à Vale em Brumadinho: desastres em barragens de mineração e saúde coletiva. Caderno Saúde Pública 35 (5): e00052519. https://doi.org/10.1590/0102-311x00052519

Jacobi CM (2008) Afloramentos ferruginosos: um ecossistema diverso e ameaçado. In: Jacobi CM (Ed) I Simpósio: Afloramentos Ferruginosos no Quadrilátero Ferrífero. Universidade Federal de Minas Gerais, Belo Horizonte, Brazil, 2–14.

Kreutz K, Fischer F, Linsenmair KE (2012) Timber plantations as favourite habitat for Giant Anteaters. Mammalia 76 (2): 137–142. https://doi.org/10.1515/mammalia-2011-0049

Miranda F, Bertassoni A, Abba AM (2014) *Myrmecophaga tridactyla*. The IUCN Red List of Threatened Species 2014: e.T14224A47441961. https://doi.org/10.2305/iucn.uk.2014-1.rlts.t14224a47441961.en

Miranda FR, Chiarello AG, Röhe F, Braga FG, Mourão GM, Miranda GHB (2015) Avaliação do risco de extinção de *Myrmecophaga tridactyla* Linnaeus 1758 no Brasil. In: Instituto Chico Mendes de Conservação da Biodiversidade (Ed.) Avaliação do risco de extinção dos xenartros Brasileiros. Instituto Chico Mendes de Conservação da Biodiversidade, Brasília, Brazil, 89–105.

Miranda FR, Chiarello AG, Röhe F, Braga FG, Mourão GM, Miranda GHB, Silva K, Faria-Corrêa MA, Vaz SM, Belentani SCS (2018) *Myrmecophaga tridactyla* Linnaeus, 1758. In: Instituto Chico Mendes de Conservação da Biodiversidade (Ed.). Livro Vermelho da fauna brasileira ameaçada de extinção: volume II – mamíferos. Instituto Chico Mendes de Conservação da Biodiversidade, Brasília, Brazil, 40–46.

Miranda GHB (2004) Ecologia e conservação do tamanduá-bandeira (*Myrmecophaga tridactyla*, Linnaeus, 1789) no Parque Nacional das Emas. PhD thesis, Universidade de Brasília, Brasília, Brazil, 104 pp.

MMA (2022) Ministério do Meio Ambiente. Gabinete do Ministro. Portaria nº 148, de 07 de junho de 2022. Brasília, Brazil, 89 pp.

MME (2011) Plano Nacional de Mineração 2030. Ministério de Minas e Energia – Secretaria de Geologia, Mineração e Transformação Mineral, Brasília, Brazil, 178 pp.

Möcklinghoff L, Schuchmann KL, Marques MI (2018) New non-invasive photo-identification technique for free-ranging giant anteaters (*Myrmecophaga tridactyla*) facilitates urgently needed field studies. Journal of Natural History 52: 2397–2411. https://doi.org/10.1080/00222933.2018.1537407

Montgomery GG (1985) The evolution and ecology of armadillos, sloths, and vermilinguas. Smithsonian Institution Press, Washington DC, USA, 451 pp.

Morcatty TQ, El Bizri HR, Carneiro HCS, Biasizzo RL, Alméri CRO, Silva ES, Rodrigues FHG, Figueira JEC (2013) Habitat loss and mammalian extinction patterns: are the reserves in the Quadrilátero Ferrífero, southeastern Brazil, effective in conserving mammals? Ecological Research 28: 935–947. https://doi.org/10.1007/s11284-01

3-1076-3

Mourão G, Medri ÍM (2007) Activity of a specialized insectivorous mammal (*Myrmecophaga tridactyla*) in the Pantanal of Brazil. Journal of Zoology 271 (2): 187–192. https://doi.org/10.1111/j.1469-7998.2006.00198.x

Oliveira MJC (2018) Análise geofísica da falha de Cata Branca-região centro-norte do Sinclinal Moeda, Quadrilátero Ferrífero. Undergraduate thesis, Ouro Preto Federal University, Ouro Preto, Brazil, 82 pp.

Rodrigues FHG, Medri IM, Miranda G, Alves CC, Mourão G (2008) Anteater behavior and ecology. In: Vizcaíno SF, Loughry WJ (Eds.) The biology of the Xenarthra. University Press of Florida, Gainesville, USA, 257–268.

Saint-Hilaire AFC de (1833) Voyage dans le district des diamans et sur le littoral du Brésil, suivi de notes sur quelques plantes caractéristiques et d'un précis de l'histoire des révolutions de l'empire brésilien: volume II. Librairie Gide, Paris, France, 404 pp.

Santos AJ (2003) Estimativas de riqueza em espécies. In: Cullen Jr L, Rudran R, Valladares-Padua C (Eds.) Métodos de estudo em biologia da conservação e manejo da vida silvestre. Editora UFPR, Curitiba, Brazil, 19–41.

Santos PM, Bocchiglieri A, Chiarello AG, Paglia AP, Moreira A, Souza A, Abba AM, et al. (2019) Neotropical xenarthrans: a data set of occurrences of xenarthran species in the Neotropics. Ecology 100 (7): 1–159. https://doi.org/10.1002/ecy.2663

VALE (2009) Plano de manejo da Reserva Particular do Patrimônio Natural Fazenda do Capivary. VALE S.A., Belo Horizonte, Brazil, 149 pp.

VALE (2010) Plano de manejo da Reserva Particular do Patrimônio Natural Córrego Seco. Bicho do Mato Meio Ambiente, VALE S.A., Belo Horizonte, Brazil, 151 pp.

VALE (2015) Plano de manejo da Reserva Particular do Patrimônio Natural Poço Fundo. VALE S.A., Belo Horizonte, Brazil, 154 pp.

Veloso HP, Rangel Filho ALR, Lima JCA (1991) Classificação da vegetação brasileira adaptada a um sistema universal. IBGE, Rio de Janeiro, Brazil, 124 pp.

Versiani NF, Bailey LL, Pasqualotto N, Rodrigues TF, Paolino RM, Alberici V, Chiarello AG (2021) Protected areas and unpaved roads mediate habitat use of the Giant Anteater in anthropogenic landscapes. Journal of Mammalogy 102 (3): 802–813. https://doi.org/10.1093/jmammal/gyab004

Vynne C, Keim JL, Machado RB, Marinho-Filho J, Silveira L, Groom MJ, Wasser SK (2011) Resource selection and its implications for wide-ranging mammals of the Brazilian Cerrado. PLoS ONE 12 (6): e0028939. https://doi.org/10.1371/journal.pone.0028939

Wied-Neuwied M (1820) Travels in Brazil in 1815, 1816, and 1817. Sir Richard Phillips and Company, London, UK, 112 pp.

Supplemental Data

A video of the camera trap record on 2 November 2020 is available as supplemental data.